

Trace Chemical Contaminant Generation Rates for System Design of Closed Habitats

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A spacecraft, or any closed habitat, presents a unique design challenge with respect to providing a comfortable environment in which people can live and work. All aspects of the environmental design, including inhabitable volume, temperature, relative humidity, and composition, must be considered to ensure the comfort and health of the occupants. The crew members and the materials selected for outfitting the spacecraft play an integral part in designing a closed habitat because material offgassing and human metabolism are the primary sources for continuous trace chemical contaminant generation inside it. Since these contamination sources cannot be completely eliminated, active control processes must be designed and deployed to assure an acceptably clean cabin atmosphere. Knowledge of the expected rates at which contaminants are generated is very important to the design of these processes. Data from past spacecraft missions and human contaminant production studies have been researched and analyzed to provide this knowledge. The resulting compilation of contaminants and generation rates serves as a firm basis for past, present, and future contamination control system designs for space and aeronautics applications.

Material offgassing data obtained from six Spacelab module missions were collected and analyzed statistically to develop an equipment offgassing rate listing for more than 200 chemical compounds. Also, the literature on past closed chamber tests conducted in the United States and Russia was researched to obtain a broad reference base for trace contaminants produced by human metabolic processes. The listing is central to the design and development of future spacecraft contamination control systems and may also be used in applications for the commercial aircraft industry.

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